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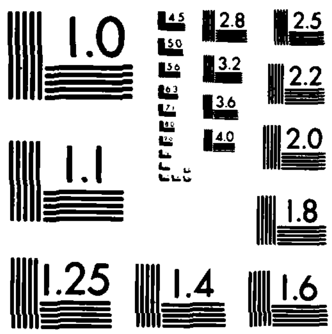

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AD-A157 499

VALIDATION OF THE ALGORITHMS FOR BASE EXCHANGEABLE REPAIR COSTS (ENGINE) AND BASE EXCHANGEABLE MODIFICATION COSTS (ENGINE) FOR THE COMPONENT SUPPORT COST SYSTEM (D160B)

Contract No. F33600-82-C-0543

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Report Number
V-83-31859-10

Submitted to:

HEADQUARTERS
AIR FORCE LOGISTICS COMMAND
MML(VAMOSC)
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EXECUTIVE SUMMARY

Visibility and Management of Operating and Support Costs is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system. VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B), which deals with subsystems and components for aircraft.

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS

replaces the Logistic Support Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The CSCS receives inputs from 15 Air Force data systems. On a quarterly basis, the system provides two standard reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on magnetic tape on a one-time basis in response to user requests. Special requests for data in user selected format may also be satisfied on a case by case basis.

At the heart of the CSCS is a set of 30 algorithms for estimation or allocation of costs. Information Spectrum, Inc. (ISI) was awarded a contract to validate these algorithms. This effort included investigations of logic, appropriateness of the algorithms and assumptions inherent in the algorithms. ISI was also to survey published findings, reports of audit, etc. relating to the accuracy to the source data systems. In addition to the algorithm validation, ISI was to perform certain "special tasks," including a user survey.

This report provides in one cover the validation of two algorithms, called "Base Exchangeable Repair Costs (Engine)" and "Base Exchangeable Modification Costs (Engine)."

The two are combined in one report because of the similarity of the subject matter and the computations processes.

Engines are returned to the depot for maintenance when the work is beyond the capability of the base. At the depot the

engines may be repaired or modified (or both). Modifications are categorized as either Class IV (reliability, maintainability or safety) or Class V (performance).

The algorithms estimate the repair and modification costs at the depot level. Because items are scheduled for efficient processing at depots, the work may take place months after receipt. The algorithms estimate costs to be incurred on the basis of depot experience with similar engines during the current reporting quarter.

In order to verify and validate the CSCS algorithms, a set of analysis procedures applicable to all of the algorithms was established. These procedures were then applied to each algorithm. This report first describes the analysis procedures, without reference to the specific algorithm addressed by this report.

Next, the algorithms are defined and described in detail. This description includes identification of source data systems and files, and the calculation procedures currently implemented by the CSCS.

Finally, a critique of the algorithm is provided as required by the contract. It addresses the following topics:

- Verification of assumptions and approximations for appropriateness and accuracy.

- Validation of accuracy of source data.

o Validation of appropriateness of source data as inputs to CSCS logic.

o Investigation of accuracy and appropriateness of algorithms.

o Consideration of replacement of indirect cost methods with more direct ones.

o Identification of algorithm impact on CSCS output reports.

For each algorithm addressed, ISI is required to affirm the process or procedure and reject any portion that cannot be affirmed. When the algorithm or portion of the algorithm is rejected, an alternate procedure must be specified.

This report affirms the basic methodology for developing base exchangeable repair and modification costs for engines. However, arguments are presented that the depot experience of the currently reported quarter may not be sufficiently representative, for algorithm purposes. Recommendations are provided for using the most recent four quarters instead of one quarter for appropriate input data.

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1.0 INTRODUCTION

Visibility and Management of Operating and Support Costs is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system (all costs are computed and portrayed in "then year" dollars). VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B), which deals with subsystems and components for aircraft.

1.1 The Component Support Cost System

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS

replaces the Logistic Support Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The objectives of the Component Support Cost System are:

(1) To improve the visibility of aircraft and engine component support costs and to relate those costs to the end item or weapon system.

(2) To improve the Life Cycle Costing capability for the Air Force and the Department of Defense in the acquisition of new weapon systems.

(3) To assist in the design of new weapon systems by providing cost information on components for existing weapon systems thereby enhancing design tradeoff studies.

(4) To provide historical cost information at the weapon system component level to improve logistic policy decisions.

(5) To identify system component reliability, effectiveness, and costs so that high support cost items may be identified and addressed.

The CSCS is described in detail in references [1], [2], and [3]. It receives inputs from 15 Air Force data systems. On a quarterly basis, the system provides two mandatory reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on

magnetic tape on a one-time basis in response to user requests. Special requests for data in user selected format may also be satisfied on a case by case basis.

The twelve reports mentioned above are of primary interest to the user community. They are identified by name in Table 1. Descriptions and samples are provided by reference (1).

TABLE 1. CSCS OUTPUT REPORTS

NUMBER*	Name
8105	Cost Factors
8104	MDS Logistics Support Costs
8106	Base Work Unit Code (WUC) Costs
8107	Total Base Work Unit Code (WUC) Costs
8111	Depot On-Equipment Work Unit Code (WUC) Costs
8108	Total Base and Depot Work Unit Code (WUC) Costs
8109	NSN-MDS-WUC Cross-Reference
8110	MDS-WUC-NSN Cross-Reference
8112	Logistic Support Cost Ranking, Selected Items
8113	Summary of Cost Elements
8114	NSN-WUC Logistics Support Costs
8115	Assembly-Subassembly WUC Costs

*CSCS output reports are assigned Report control Symbol HAF-LEY (AR)nnnn, where nnnn is the number in the table.

At the heart of the CSCS is a set of 30 algorithms for estimation or allocation of costs. The algorithms are identified by name in Table 2. Information Spectrum, Inc. (ISI) was awarded a contract to validate these algorithms. This effort includes investigations of logic, appropriateness of the algorithms, and assumptions inherent in the algorithms. ISI was also to survey published findings, reports of audit, etc. relating to the accuracy of the source data systems. In addition to the algorithm validation, ISI was to perform certain "special tasks," including a user survey.

1.2 Overview of the Algorithms

This report provides the verification and validation of algorithms 13 and 16 of Table 2, "Base Exchangeable Repair Costs (Engine)", and "Base Exchangeable Modification Costs (Engine)." The two algorithms are covered by a single report because the subject matter and the computational processes are similar.

Air Force engine management uses a new reporting system, the Comprehensive Engine Management System, with Data System Designator D042. This system, described in reference (30), generates reports when engines are shipped or received, when maintenance starts or stops, and other events of significance in engine management. From this system, the CSCS determines when engines arrive at depots. At the time of generation of this report, documentation concerning data received from D042 and CSCS processing of that data was not yet available. Moreover,

TABLE 2. CSCS ALGORITHM NAMES

1. Base TCTO Labor Cost
2. Base TCTO Overhead Cost
3. Base TCTO Material Cost
4. TCTO Transportation Costs
5. Base Inspection Costs
6. Base Other Support General Costs
7. Base Labor Costs
8. Base Direct Material Costs
9. Base Maintenance Overhead Costs
10. Second Destination Transportation Costs
11. Second Destination Transportation Costs (Engine)
12. Base Exchangeable Repair Costs (NSN)
13. Base Exchangeable Repair Costs (Engine)
14. Base Exchangeable Modification Costs (NSN)
15. Base Condemnation Spares Costs/NSN
16. Base Exchangeable Modification Costs (Engine)
17. Base Supply Management Overhead Costs
18. Depot TCTO Labor Costs
19. Depot TCTO Material Costs
20. Depot TCTO Other Costs
21. Depot Support General Costs
22. Depot Labor Costs
23. Depot Direct Material Costs
24. Depot Other Costs
25. Depot Exchangeable Repair Costs (NSN)
26. Depot Exchangeable Repair Costs (Engine)
27. Depot Exchangeable Modification Costs (NSN)
28. Depot Exchangeable Modification Costs (Engine)
29. Depot Condemnation Spares Costs (NSN)
30. Depot Material Management Overhead Cost

according to personnel of the Office of VAMOSC, the data processing procedures are in the process of adjustment and revision. This report reflects Information Spectrum's understanding of the way the programs are currently intended to work.

Months may elapse from the time an engine arrives at a depot until work is begun. The CSCS develops the expected costs of engine repairs and modifications from work in progress in the current reporting quarter, and associates these costs with the engines shipped, by engine TMS, by base and by MDS.

First, the system determines the total number of each engine TMS shipped to each depot by base and by aircraft SRD during the quarter. This identification permits the association of costs with a particular MDS at a particular base.

From the H036B data system, factors are developed to estimate the proportions of engines being repaired or modified at the depot. Class IV (reliability, maintainability, or safety) and Class V (performance) modifications are treated separately. Applying these factors to the counts of engines shipped yields estimates of the number of engines repaired or modified. These estimates are multiplied by average costs which are developed separately for repairs, Class IV modifications, or Class V modifications, yielding the desired results. The average costs are based on the costs (from data system H036B) which were incurred for engines of the same TMS at the depot for the quarter.

2.0 ANALYSIS PROCEDURES

In order to verify and validate the CSCS algorithms, a set of analysis procedures applicable to all of the algorithms was established. These procedures were then applied to each algorithm. This section describes the analysis procedures, without reference to the specific algorithms addressed by this report.

The algorithm analysis process consists of five portions, described in the following sections.

2.1 Algorithm Description

The algorithms are described in references [1], [2], and [3]. These descriptions are not identical. In general they supplement, rather than contradict each other. The first two describe what the system is to achieve; the third describes the system design to do so.

None of these descriptions provides the combination of level of detail and clarity of concept required for this validation effort. The first step in the analysis methodology was the generation of such a description. The descriptions in the three reference sources just cited were made explicit. When necessary, Air Force personnel involved in implementation of the D160B subsystem were contacted for clarification.

2.2 Input Data Definitions

Closely related to the first step was the clarification of the definitions of the input data. The identification of each input data element and of the system providing it was provided by the User's Manual (reference [1]). This identification was refined by identification of a particular file within the source system and the structure of the file as described in both the CSCS System/Subsystem Specification and in the Memoranda of Agreement. The Memoranda of Agreement have been established between the Office of VAMOSC and the Offices of Primary Responsibility (OPR) for the systems providing the input data. Any inconsistencies or voids were identified and resolved through contact with the Office of VAMOSC and/or implementing personnel.

Whenever appropriate, input data element definitions were further refined by tracing the elements back to their sources through the reference data provided. If these were inadequate, the OPRs were contacted directly for clarifications. In tracing the data back to their origins, possible sources of data contamination were considered. Information on the likelihood and significance of such contamination was collected from cognizant personnel and from published references.

2.3 Concept Validation

The two steps above established exactly what the algorithm does. The third, and most critical step, considered the validity of the procedure. It depended on the ability of the analyst to

translate mathematical formulas and data processing techniques into meaningful concepts.

Some explicit techniques which were generally used in concept validation are listed below.

(a) Consider how the cost element would be calculated if there were no constraints on resources. (For example, suppose the CSCS could identify the pay grade and hours worked of each individual involved in a maintenance action.)

(b) Identify assumptions* incorporated into the Algorithm. Generally this procedure will identify the real constraints which affect the approach in (a) above.

(c) Identify approximations incorporated into the algorithm. For instance, one such approximation is the use of an average labor rate for each aircraft.

(d) Study each approximation for possible sources of error. Some examples are biases introduced by editing procedures, obsolete data, or inappropriate application. Whenever feasible, estimate the likelihood of these errors by reviews of the literature and contact with cognizant personnel.

* Note that assumptions, approximations, and allocations are different concepts, although in some cases the boundaries between them are not sharp. ISI has recognized few assumptions in the algorithms, but many approximations and allocations.

(e) Test the algorithms under conditions of assumed extreme values for the inputs. For instance, in evaluating the algorithm for base maintenance overhead costs, assume that for a single reporting period all maintenance labor is overhead and none is direct. Also try the reverse assumption. If an assumption of an extreme input leads to an illogical result, the algorithm is flawed.

Task 4 of Section C-2, c of the contract speaks of appropriate statistical techniques to confirm or repudiate each algorithm. Statistical techniques could confirm or repudiate only statistical hypotheses as assumptions. (Use of an average does not constitute an assumption.) Accordingly, statistical techniques apply to confirmation or repudiation of an algorithm only to the extent that statistical hypotheses can be developed.

(f) As each algorithm is considered, ensure that the costs do not overlap others already accounted for. (In some cases an overlap may be necessary and desirable. Where this occurs, the overlap will be noted.)

(g) In each CSCS output report, identify the data elements incorporating the output of the algorithm, so that a final assessment of report accuracy can be made for each output report.

(h) Consider alternative sources of input data for the

algorithm. Also consider more direct cost assignments then those incorporated in the algorithm.

2.4 Problem Resolution

Whenever a significant deficiency was recognized in one of the algorithms, one or more proposed solutions were developed. This was a creative analytic process for which few guidelines could be proposed in advance. Certainly it depended on familiarity with the various existing Air Force data reporting and processing systems. Proposed solutions were discussed with personnel of the Office of VAMOSC, and revised as appropriate. Recommended solutions were expressed in the form of contributions to a draft Data Automation Requirement (DAR) when these would be applicable.

2.5 Documentation

The documentation of the analysis of each algorithm was a crucial part of the effort. Emphasis was placed on making it thorough, clear, and unambiguous. In the documentation, every assertion was substantiated. This was done by reference to source documentation, by explicitly expressed application of the experience and judgment of the contractor, or by citation of information provided by cognizant Air Force personnel. In the last case, the information was supported by documentation identifying the source, the date, and the information provided.

3.0 ALGORITHM ANALYSIS

The previous section described the general analysis procedures applied to all algorithms. This section presents the results of applying those procedures to the algorithms for Base Exchangeable Repair Costs (Engine) and Base Exchangeable Modification Costs (Engine). It should be recognized that throughout this report the word "engine" may refer to an entire aircraft engine or to an engine module, in the case of a modular engine. At present, there are two modular engines in use in the Air Force, the F-100 and the T-56 (reference [30] Section 8-2f).

Section 3.1 provides a detailed description of the algorithms and of the input data they use. Section 3.2 provides a critique, structured to correspond to the contractual requirements. Section 4.0 makes recommendations for solutions of problems.

3.1 Algorithm Description

In the following description COBOL-type data names are used to express the algorithm outputs and their components. The available source documentation does not provide the actual data names used by the CSCS programs. They are presumably different from those used in this report.

This description provides formulas for the calculation that are derived from the Users Manual and other sources. They are not the same as the formulas provided in the Users Manual. They are intended to be more explicit. The formulas are stated in Section 3.1.1. The input data elements and their sources are

provided in Section 3.1.2. The calculations are described verbally in Section 3.1.3. Unless otherwise noted, the descriptions are based on references [1], [2], and [3], and on direct discussion with personnel of the Office of VAMOSC. In case of any discrepancies, information provided by knowledgeable personnel was accepted as most current, hence most definitive.

3.1.1 Calculations

For purposes of this analysis, it is convenient to express the calculations performed by the two algorithms by nine formulas:

(1) AVE-REP-COST = TOT-REP-COST/REP-COUNT

(2) AVE-MOD-IV-COST = TOT-MOD-IV-COST/MOD-IV-COUNT

(3) AVE-MOD-V-COST = TOT-MOD-V-COST/MOD-V-COUNT

(4) REPAIR-FRAC = REPAIR-COUNT/PRODN-COUNT

(5) MOD-IV-FRAC = MOD-IV-COUNT/PRODN-COUNT

(6) MOD-V-FRAC = MOD-V-COUNT/PRODN-COUNT

(7) ENG-REP-COST = QTY-RCVD x REPAIR-FRAC x AVE-REP-COST

(8) ENG-MOD-IV-COST = QTY-RCVD x MOD-IV-FRAC x AVE-MOD-IV-COST

(9) ENG-MOD-V-COST = QTY-RCVD x MOD-V-FRAC x AVE-MOD-V-COST

3.1.2 Inputs

Name: TOT-REP-COST

Definition: Total of all repair costs at depot level (organic or contractor) for the engine for the quarter.

Source System/File: H036B/AHMORA1

Name: REP-COUNT

Definition: Number of engines reported as completed at the depot level and categorized as repair for the quarter.

Source System/File: H036B/AHMORA1

Name: TOT-MOD-IV-COST

Definition: Total of all costs of Class IV modifications at depot level (organic or contractor) for the engine for the quarter.

Source System/File: H036B/AHMORA1

Name: TOT-IV-COUNT

Definition: Number of engines reported as completed at the depot level and categorized as Class IV modifications for the quarter.

Source System/File: H036B/AHMORA1

Name: TOT-MOD-V-COST

Definition: Total of all costs of Class V modifications at depot level (organic or inorganic) for the engine for the quarter.

Source System/File: H036B/AHMORA1

Name: TOT-V-COUNT

Definition: Number of engines reported as completed at the depot level and categorized as Class V modifications for the quarter.

Source/File: H036B/AHMORA1

Name: PRODN-COUNT

Definition: Number of engines reported as completed at the depot level for the quarter.

Source System/File: H036B/AHMORA1

Name: QTY-RCVD

Definition: Number of engines* received at depot for major overhaul. Counts are accumulated separately by aircraft MDS, by engine (identified by Configured Item Identifier. See reference (30), Section 10-1.j.), and by originating base (identified by SRAN).

Source System/File: D042/(File not identified at this time)

3.1.3 Description of Calculation Procedure

The following discussion explains the calculation procedures implicit in the calculations of Section 3.1.1 as applied to the inputs defined in Section 3.1.2. The calculation procedures are very similar to those used for NSNs, reported in reference [37].

In order to understand the logic, it should be recognized that months may elapse from the time an engine is received at a depot for overhaul# until the work is completed. The VAMOSC system associates the costs of depot activities with the time of receipt at the depot. Since the actual costs are not yet determined at that time, VAMOSC uses estimated costs. Engines may be repaired, subjected to Class IV modifications, or subjected to Class V modifications at the depot. As will be

* Auxiliary power units are not counted.
\# Depot level work on engines is commonly called "overhaul".

discussed in Section 3.2.4, repair and the two classes of modifications constitute all of the depot costs associated with engines.

Formulas (1) through (6) of Section 3.1.1 all use data from system H036B. Table 3, extracted from reference [3], lists the data elements extracted from that system. The CSCS selects records containing these elements according to the following criteria. First, element 010 is the item identification number. It may identify an aircraft, an engine, or a stock numbered component. The former two possibilities are identified by inclusion of an alphabetic character in the item identifier. For the algorithms considered in this report, only such records are considered, bypassing the stock numbered items. Moreover, only records with an "A" as the first element of the Work Breakdown Structure (element 017) are selected. This code identifies aircraft applications. Finally, only elements with a "2" as the third element of the Work Breakdown Structure (element 019) are selected. This code identifies engines.

Element 020 of Table 3 is the Work Performance Code. Table 4, extracted from reference [1], identifies the possible entries. Codes A, B, G, I, J, and K are identified by the CSCS as repair actions. Code C identifies Class V and Code E Class IV modifications. Codes D, E, L, and M are not relevant to engine repair.

TABLE 3 H036B DATA ELEMENTS

ELEM NR	LVL NR	LONG TITLE OF DATA ELEMENT (FIRST 50 CHAR)
001	01	INTERROGATION REQUEST TAPE
002	03	TYPE, RECORD
003	03	CODE, QUARTER
004	03	YEAR, FISCAL
005	03	CODE, PROGRAM ELEMENT
006	03	NAME, FACILITY
007	03	CODE, AREA, CONUS OR OVERSEA
008	03	CODE, OWNERSHIP PURPOSE
009	03	CODE, FACILITY, REPORTING
010	03	NUMBER, ITEM IDENTIFICATION
011	03	NOMENCLATURE, ITEM
012	03	PRICE, STANDARD INVENTORY
013	03	CODE, WEAPON SYSTEM SUPPORT
014	05	CODE, WEAPON SYSTEM SUPPORT, POSITIONS 1 TO 3
015	05	CODE, WEAPON SYSTEM SUPPORT, POSITION 4
016	03	CODE, WORK BREAKDOWN STRUCTURE
017	05	CODE, MAJOR COMMODITY GROUP
018	05	CODE, CATEGORY OF WEAPON SYSTEM
019	05	CODE, COMPONENT OF WEAPON SYSTEM
020	03	CODE, WORK PERFORMANCE
021	05	DESIGNATOR, JOB
022	05	FILLER
023	03	CODE, CUSTOMER
024	03	COST, PRODUCTION, DIRECT LABOR, CIVILIAN
025	03	HOURS, PRODUCTION, DIRECT CIVILIAN LABOR
026	03	COST, OTHER, DIRECT LABOR, CIVILIAN
027	03	HOURS, OTHER, DIRECT CIVILIAN LABOR
028	03	COST, PRODUCTION, DIRECT LABOR, MILITARY
029	03	HOURS, PRODUCTION, DIRECT MILITARY LABOR
030	03	COST, OTHER, DIRECT LABOR, MILITARY
031	03	HOURS, OTHER, DIRECT MILITARY LABOR
032	03	COST, FUNDED, DIRECT MATERIAL
033	03	COST, UNFUNDED, DIRECT MATERIAL INVESTMENT
034	03	COST, UNFUNDED, DIRECT MATERIAL EXCHANGE
035	03	COST, UNFUNDED, DIRECT MATERIAL, MODIFICATION KITS
036	03	COST, UNFUNDED, DIRECT MATERIAL EXPENSE
037	03	COST, FUNDED, OTHER DIRECT
038	03	COST, UNFUNDED, OTHER DIRECT
039	03	COST, FUNDED, OPERATIONS OVERHEAD
040	03	COST, UNFUNDED, OPERATIONS OVERHEAD
041	03	COST, FUNDED, GENERAL AND ADMINISTRATIVE
042	03	COST, UNFUNDED, GENERAL AND ADMINISTRATIVE
043	03	COST, CONTRACT OR INTERSERVICE
044	03	COST, GOVERNMENT FURNISHED MATERIAL, INVESTMENT
045	03	COST, GOVERNMENT FURNISHED MATERIAL, EXCHANGE
046	03	COST, GOVERNMENT FURNISHED MATERIAL, MODIFICATION
047	03	COST, GOVERNMENT FURNISHED MATERIAL, EXPENSE
048	03	COST, FUNDED, GOVERNMENT FURNISHED SERVICES
049	03	COST, UNFUNDED, GOVERNMENT FURNISHED SERVICES
050	03	COST, FUNDED, MAINTENANCE SUPPORT
051	03	COST, UNFUNDED, MAINTENANCE SUPPORT
052	03	QUANTITY, PRODUCTION
053	03	FILLER
054	03	QUANTITY, ITEMS INDUCTED REPORTING YEAR
055	03	QUANTITY, ITEMS INDUCTED PREVIOUS YEAR
056	03	QUANTITY, ITEMS INDUCTED ALL PRIOR YEARS
057	03	WORK DAYS IN PROCESS
058	03	CODE, CLASSIFICATION, JOB ORDER NUMBER
059	03	FILLER
060	03	COST, FUNDED, TOTAL
061	03	COST, UNFUNDED, TOTAL

TABLE 3 H036B DATA ELEMENTS (Continued)

ELEM NR	LVL NR	LONG TITLE OF DATA ELEMENT (FIRST 50 CHAR)
062	03	COST, AVERAGE UNIT REPAIR
063	03	NUMBER, PROGRAM CONTROL
064	05	CODE, REIMBURSEMENT
065	05	CATEGORY, REPAIR GROUP
066	05	CODE, PSEUDO
067	07	CODE, AIR LOGISTICS CENTER
068	07	CODE, PSEUDO, LAST 3 POSITIONS
069	03	CODE, STATUS, PRODUCTION
070	03	CODE, MATERIEL MANAGEMENT
071	03	CODE, WEAPON SYSTEM SUPPORT
072	05	CODE, WEAPON SYSTEM SUPPORT, POSITIONS 1 TO 3
073	05	CODE, WEAPON SYSTEM SUPPORT, POSITION 4
074	03	CODE, WORK BREAKDOWN STRUCTURE
075	05	CODE, MAJOR COMMODITY GROUP
076	05	CODE, CATEGORY OF WEAPON SYSTEM
077	05	CODE, COMPONENT OF WEAPON SYSTEM
078	03	NUMBER, JOB ORDER
079	05	NUMBER, CONTROL, 1ST POSITION
080	05	FILLER

TABLE 4 WORK PERFORMANCE CATEGORIES

Code A—Overhaul. The disassembly, test, and inspection of the operating components and the basic structure to determine and accomplish the necessary repair, rebuild, replacement and servicing required to obtain the desired performance. It is considered to be synonymous with the terms "rework" or "rebuild."

Code B—Progressive Maintenance. A predetermined amount of work that presents a partial overhaul under a program that permits the complete overhaul to be accomplished during two or more time periods. It is considered synonymous with the terms "cycle maintenance," "restricted availability," "preventive servicing," or "recondition."

Code C—Conversion. The alteration of the basic characteristics of an item to such an extent as to change the mission, performance or capability.

Code D—Activation. The depreservation, servicing, inspection, test and replacement of assemblies or subassemblies as required to return an item from storage or inactive pool status to operational use.

Code E—Inactivation. The servicing and preservation of an item prior to entering storage or an inactive pool.

Code F—Renovation. The proof and test evaluation and rework of ammunition or ordnance items as required for retaining their desired capability.

Code G—Analytical Rework. The disassembly, test and inspection of end-items, assemblies or subassemblies to determine and accomplish the necessary rework, rebuild, replacement, or modification required. It includes the technical analysis of the findings and determination of maintenance criteria. Includes prototype tear-down, analysis and rework of an item to determine job and material specifications on a future workload.

Code H—Modification. The alteration or change of the physical makeup of a weapon/support system, subsystem, component, or part in accordance with approved technical direction.

Code I—Repair. Action taken to restore to a serviceable condition an item rendered unserviceable by wear, failure, or damage.

Code J—Inspection and Test. The examination and testing required to determine the condition or proper functioning as related to the applicable specifications.

Code K—Manufacture. The fabrication of an item by application of labor and/or machines to material.

Code L—Reclamation. The authorized processing of end-items, assemblies or subassemblies to obtain parts or components that are to be retained in the inventory prior to taking disposal action on the remaining items. Covers demilitarization actions on items prior to disposal when the demilitarization is incidental to the reclamation.

Code M—Storage. The inspection, representation and maintenance in a storage status of weapons and equipment items as well as their subsystems and components in the supply system.

Code N—Technical Assistance. The use of qualified depot maintenance personnel to provide technical information, instructions, or guidance, or to perform specific work requiring special skills, for operational activities or other maintenance organizations. Includes all demilitarization other than the incidental to reclamation (Code L).

Code O—Not Used.

Code P—Programming and Planning Support. Includes consolidated long-range workload scheduling and resource utilization; centralized maintenance programming and planning for support of all levels of maintenance; all logistics support exclusive of engineering effort in the programming and development of maintenance support requirements for weapon systems and weapons support activities.

Code Q—Maintenance Technical and Engineering Support. Includes the technical and engineering effort in development of maintainability concepts and the maintenance portion of logistics plans dealing with future and present weapons and equipment. Includes regional maintenance representatives, field liaison, maintenance technicians, contract technical services, contract engineering services in direct support of maintenance, contract technicians and engineers in direct support of maintenance.

Code R—Technical and Engineering Data. Includes the preparation of technical and engineering data as applied to all categories of equipment. Includes engineering drawings, wiring diagrams, technical orders, engineering technical standards, technical handbooks, technical bulletins and similar publications. Provides for the preparation, editorial review and/or revision of equipment publications pertaining to the operation, repair and repair parts support of DOD materiel. Preparation includes, but is not limited to, the consolidation of source data, drawings and art work, editing, preparation of final printable copy and printing. Includes significant identifiable effort within organic maintenance or at other DOD specialized support functions to produce data in support of maintenance, such as cryptographic or test equipment support data.

Code S—Technical and Administrative Training. In-

...udes educational units conducting maintenance training and training associated with new weapon systems or support systems which have been or will be introduced into the DOD inventory. At depot maintenance activities, only training associated with new equipment is maintenance support. This training is separately funded by specific funding documents. Other training accomplished at depot maintenance activities in support of the depot maintenance operation is not maintenance support, but a part of the depot maintenance operation.

Code T—Nonmaintenance Work. Used to assure completeness of maintenance work force reporting.

The remaining codes correspond to administration, planning, training, etc., and are not associated with engine maintenance.

The input identified as ENG-REP-COST is the sum of all applicable costs (see Section 3.2.2.2) for selected records with Work Performance Codes A, B, G, I, J, or K. REPAIR-COUNT is the sum of the production counts for the same records. Similarly, inputs for Class IV modifications are based on Work Performance Code H, and Class V modifications on Work performance Code C. The input PRODN-COUNT is simply the sum of the production counts for three cases.

Thus the average costs of formulas 3.1.1 (1), (2), (3) are simply the quotients of the applicable costs and associated production quantities. Formulas (4), (5), and (6) determine what fractions of total production were repairs, Class IV modifications, or Class V modifications in the reported quarter. The total production count for the engine (including both modification and repairs) is the common denominator of these fractions, so the fractions add up to one.

Formulas (7), (8), and (9) all begin with the number of engines received at the depot for overhaul. Section 4-5.v(1)(a) of reference [30] shows that the report of receipt of an engine includes the "document number from...DD1348-1." Section 2.a(4) of Chapter 3 of reference [25] shows that this document number includes the SRAN of the shipper. In the case of engines processed through a "Queen Bee" facility as described in Section

3.2.4 of this report, it is believed that this number will identify the base of origin, not the Queen Bee. At the time of generation of this report, this remains to be verified.

Reference [1] assumes that engines are never condemned. This was informally confirmed by Mr. Ludwig Coco (AFLC/MMMAE) who indicated that the frequency of engine condemnations is negligible. The number of engines received at the depot is multiplied by the appropriate fraction to estimate the number repaired or modified in each case.

Finally, these estimates are multiplied by the applicable average unit costs (repair, Mod IV, or Mod V costs) to yield estimates of engine exchangeable repair costs (ENG-REP-COST), engine Class IV modification costs (ENG-MOD-IV-COST), and engine Class V modification costs (ENG-MOD-IV-COST). Since the counts of engines received are accumulated separately by MDS, TMS, and base, the resulting cost estimates are similarly identified.

3.2 Critique of Algorithms

This section addresses various facets of the two algorithms. The discussion is structured to correspond to the contractual requirements. Each aspect is either affirmed or rejected. Rejections lead to recommendations in Section 4.0.

3.2.1 Appropriateness and Accuracy of Assumptions and Approximations

Information Spectrum has identified two approximations and one assumption used in these algorithms. The approximations are

addressed in Section 3.2.1.1, and 3.2.1.2, the assumption in Section 3.2.1.3.

3.2.1.1 Depot Processing of Engines

Engines received at the depot may be subjected to repair (scheduled or unscheduled) or Class IV or Class V modification. The data used by the CSCS to identify the arrival of an engine at the depot does not identify which of these will be the case. The number of engines processed in each way is estimated by an approximation based on depot experience for the current quarter.

While the use of an approximation based on depot experience is appropriate, Information Spectrum feels that the use of ratios from the current quarter is undesirable. Depot activities for a given engine may be delayed to permit accumulation of a number of engines before beginning some type of work. Thus a selected engine modification or repair might not occur at all for several quarters, and then a batch of them could occur. Thus the quarterly proportions of engines repaired or modified could fluctuate in a manner not representative of the expected disposition of engines sent to the depot. Section 4.1 recommends a change in procedure.

3.2.1.2 Cost Averages

The average cost for repair or for modification used by the CSCS is the average observed for these activities at the depot for the current quarter. In accordance with the discussion of

Section 3.2.1.1, it may occur that there are no repairs or no modifications of a selected class during the quarter. The CSCS makes no provision for this situation. The recommendation of Section 4.2 addresses this problem.

3.2.1.3 Condemnations

The CSCS assumes that no engines are ever condemned. This was confirmed through informal discussion with Mr. Ludwig Coco (AFLC/MMMAE), who indicated that engine condemnation is extremely rare. Information Spectrum affirms the acceptability of this assumption.

3.2.2 Accuracy of Source Data and Congruence of Data Element Definitions

Information Spectrum was directed to validate accuracy of source data based on a survey of published findings, reports of audit, etc. No direct sampling of data was to be performed. The Office of VAMOSC has indicated that direct validation of source data is planned for future efforts.

As indicated in Section 3.1.2, the input data is provided to the CSCS by data systems H036B and D042. No published criticism of the accuracy of any of these data systems could be found. Accordingly, ISI affirms their accuracy.

Next the congruence between definitions of input data elements as used by the CSCS and as provided by the input data systems are addressed.

3.2.2.1 Depot Costs

The depot costs used by the CSCS are the sum of all applicable

cost elements reported by H036B. Table 3, extracted from reference [3], lists the data elements provided by that system. In the table, elements numbered 024, 026, 028, 030, and 032 through 051 are the cost elements. All of these elements are summed by the CSCS to yield the total depot cost for each Work Performance Category and Engine. The cost elements derive from reference [29], which implicitly requires that all depot maintenance costs for the military departments be identified by these categories. It may be noted that the listing of H036B data elements in reference [1] omits data elements 042, 043, and 050. Reference [3] is more accurate.

Various knowledgeable Air Force personnel have noted that it is not unusual for an engine to be both repaired and modified during one visit to the depot. According to Mr. Dennis Kahn (OPR for H036B), in such a case a single H036B record is generated. The record is generally coded as a repair or a modification record depending on which activity involved the greatest cost. Thus, users should recognize that cost outputs associated with repair or with modification by the CSCS may incorporate some costs of the other type. Users should also recognize that both funded and unfunded costs are included in the H036B cost elements so that the cost estimates developed by the CSCS include cost elements not used in calculation of standard depot repair prices ("sales prices"). ISI affirms the congruence of the definitions of repair prices as provided by H036B and as used by the CSCS,

with the provision that users of CSCS output data should be clearly informed of the nature of the cost elements included.

3.2.2.2 Production Counts

Section 3.1.3 of this report explained how production counts represent completed depot level actions categorized by the nature of the work done. The resulting counts are straightforward, with the understanding that engines which are both modified and repaired are counted only in the category with the greater cost. ISI affirms the congruence of the input definitions and the CSCS interpretations.

3.2.2.3 Depot Receipts of Engines

When an engine is shipped to a depot from a base, or a "Queen Bee" activity, the depot generates a single report of receipt of that engine when it is received. This report is entered into the D042 system as described in reference [30]. According to cognizant Air Force personnel, all such receipts lead to repairs or modifications (or both). ISI affirms the congruence of the input data definition with the CSCS interpretation.

3.2.3 Appropriateness of the Source Data as Inputs

The H036B system is designed to record depot costs. The D042 system has recently been implemented. It is designed to track all significant information on the status, condition, and location of aircraft engines and related equipment. ISI affirms the appropriateness of both systems as inputs to the algorithms.

3.2.4 Accuracy and Appropriateness of Algorithms

It has previously been noted that these algorithms are very similar to algorithms 12 and 14 of Table 2. The latter algorithms address depot maintenance of repairable stock numbered items other than engines, conveniently identified as "NSNs." Reference [37] affirmed the appropriateness of algorithms 12 and 14, and recommended some modified procedures to improve their accuracy.

There are two important differences between engines and NSNs which prevent the simple adoption of the same conclusions in this report. First, there is the "Queen Bee" concept. Engines are larger and more complex than NSNs, and require more extensive resources for maintenance. In many cases, base level engine maintenance (called "intermediate" maintenance) is not performed at the base where the aircraft is deployed. Instead, intermediate maintenance is performed at central or regional facilities that have a consolidation of skills and tooling. These facilities are called "Queen Bees." Typically, an engine is shipped from a base to a Queen Bee for repair or for forwarding to a depot. Such shipped engines will normally have the Quick Engine Change (QEC) kit installed. At the Queen Bee, the QEC kit is removed. Modular engines are separated into modules. If depot work is required, the engine or module is shipped from the Queen Bee to the depot. On return from the depot the QEC kit is reinstalled, and then the engine is sent back to the base. It has

been estimated by Mr. Ludwig Coco (AFLC/MMMAE) that on the order of 30% of base level engine transactions involve a Queen Bee.

The other important difference between NSNs and engines is that NSNs, when they are shipped to a depot, lose all association with the base and aircraft from which they came. It is appropriate to think of NSNs as thrown into a bin with similar items from other sources. Engines, on the other hand, are tracked by serial number throughout their life. Even in the most extreme imaginable case, when an engine has suffered severe crash damage, the identification plate goes on, and repair components are associated with its number.

In the discussion of depot repair of NSNs, it was noted that the CSCS associates repair costs with the quarter in which the NSN was reported NRTS by the base. In reality, these items may not yet have been processed by the depot, so the algorithms use estimates of the depot costs which will be incurred. When a base ships an engine to a Queen Bee, it is not appropriate to associate an estimate of depot costs, because it is not yet known whether the engine will require depot maintenance. Thus it is neither possible nor appropriate to associate a depot cost with the shipment of an engine from a base. Instead, the cost is associated with the report of receipt at the depot, in contrast with the treatment of NSN costs.

The net effect of the differences between CSCS treatment of engines and of NSNs is that engine costs are associated with the

time of receipt at the depot rather than the time of turn-in by the base. This is not significant for the accuracy or appropriateness of the algorithm. Information Spectrum affirms the appropriateness of the algorithm.

Section 4 of this report provides recommendations to improve the accuracy of approximations discussed in Sections 3.2.1 and 3.2.2. If these are implemented, we believe the accuracy will be satisfactory.

3.2.5 Directness of Costing

Having acknowledged that the repair cost of items NRTS'd to the depot must be based on representative, not actual depot cost values, it is appropriate here to consider whether the representative depot costs are direct. Discussion with Air Force personnel indicates that cost elements in H036B are as direct as feasible. For instance, direct labor and material costs are directly identified with the item being worked on, and are so reported. Overhead, and general and administrative (G&A) costs are generally accrued at the Air Logistics Command or Resource Control Center level, and then allocated to the direct labor tasks. Reference [29] requires that operations overhead costs be allocated in proportion to direct labor hours. Indirect costs coded in H036B are allocated to NSNs "in proportion to benefits received," and G&A costs are allocated in proportion to the total of direct and indirect costs. Information Spectrum, Inc. affirms the directness of costing used in these algorithms.

3.2.6 Application to CSCS Output Reports

The costs addressed by these algorithms relate to engines turned in by bases. They should not be confused with similarly titled costs associated with work on the entire aircraft or NSN's at the depot.

The costs generated by these algorithms impact elements of six CSCS reports as described by Table 5. The accuracy and limitations described for the algorithms by this report impacts certain elements of the CSCS reports listed in Table 5. The total accuracy of each report cannot be addressed until all algorithms impacting the report and its respective cost elements have been reviewed. This will occur in the final report of this effort. Evaluation of the usefulness of the reports will also be provided in the final report of this effort and after ISI conducts a survey of users.

TABLE 5

CONTRIBUTION OF BASE EXCHANGEABLE REPAIR COST AND BASE EXCHANGEABLE MODIFICATION COST ALGORITHMS FOR ENGINES TO CSCS OUTPUT REPORTS

OUTPUT REPORT/NUMBER[1]	COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHMS[2]
1. Base Work Unit Code (WUC) Costs/8106	1. By base and MDS: WUC COSTS a. EXCH REPAIR b. EXCH MOD IV c. EXCH MOD V d. TOTAL WUC
2. Total Base Work Unit Code (WUC) Costs/8107	2. By MDS for all bases: WUC COSTS a. EXCH REPAIR b. EXCH MOD IV c. EXCH MOD V d. TOTAL WUC
3. Total Base and Depot Work Unit Code (WUC) Costs/8108	3. By MDS and WUC for all bases: a. BASE EXCHANGE REPAIR COSTS (1) REPAIR (2) MOD IV (3) MOD V b. BASE & DEPOT WUC TOTAL
4. Summary of Cost Elements/8113	4. By MDS for all bases: a. COMPONENT REPAIR, BASE EXCHANGE REPAIR COST b. CLASS IV MODIFICATIONS,[3] BASE EXCH MOD COSTS (1) LABOR (2) OTHER c. SUSTAINING INVESTMENT, MODIFICATION KITS, BASE EXCH MOD COSS, CLASS IV

(1) CSCS output reports are assigned Report Control Symbol HAF-LEY (AR) nnnn, where nnnn is the number in the table.

(2) Capital letters indicate the titles printed on the report.

(3) Report is erroneously labeled; it shows combined costs of Class IV and Class V modifications.

TABLE 5 (Continued)

OUTPUT REPORT/NUMBER[1]	COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHMS[2]
5. NSN-WUC Logistics Support Cost/8114	5. By NSN, MDS, and WUC for all bases: a. BASE COSTS (1) EXCH REPAIR (2) EXCH MOD (CL IV) (3) EXCH MOD (CL V) b. TOTAL NSN
6. Assembly-Subassembly WUC Costs/8115	6. By MDS and WUC for all bases: a. BASE EXCH REPAIR COSTS (1) REPAIR (2) MOD IV (3) MOD V b. BASE & DEPOT WUC TOTAL

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(1) CSCS output reports are assigned Report Control Symbol HAF-LEY (AR) nnnn, where nnnn is the number in the table.

(2) Capital letters indicate the titles printed on the report.

4.0 Recommendations

Section 3 has presented an assessment that the algorithms for Base Exchangeable Repair Costs (Engine) and Base Exchangeable Modification Costs (Engine) are fundamentally sound. Two procedural weaknesses were identified in Section 3.2.1. The following recommendations address these weaknesses.

In the Air Force Logistics Command, changes to automated data systems are initiated through preparation of AFLC Form 238, "Data Automation Requirements," (DAR). This form contains a number of administrative entries, together with three items of substantive content: "Requirements," "Impact Statement," and "Justification Benefits/Cost Savings." Attachment 1 provides a draft of these sections appropriate to the recommendations below. (It is appropriate to address both recommendations by a single DAR.)

4.1 Depot Production Counts

In Section 3.1.1, formulas (1) through (7) use inputs identified as REPAIR-COUNT, MOD-IV-COUNT, MOD-V-COUNT, and PRODN-COUNT. Section 3.1.2 identified each of these inputs as a count of activities for the current quarter.

It is recommended that each of these definitions be changed so that the input quantity is the accumulated count for the most recent four quarters. Note that use of four quarters would avoid any seasonal biases.

It is conceivable that no counts would be accumulated for some class of data even over a full year. Accordingly, the

following rule is recommended for formulas (4), (5), and (6) of Section 3.1.1: If the denominator in the formula is zero, the value used in the previous quarterly processing cycle should be re-used in the present processing cycle.

4.1a <u>Office of VAMOSC (00V) Comments</u>

Concur. The use of data for the current quarter only for computation of depot repair and modification percentages may cause some distortion of the data when activity is low for a particular TMS. By using accumulated counts for the most recent four quarters to compute the percentages, we should portray more accurately the costs associated with depot maintenance. A DAR requesting this change will be prepared and submitted by 31 May 84.

4.2 <u>Average Costs</u>

In Section 3.1.1, formulas (1), (2), and (3) calculated average depot costs for repair, Class IV modification, or Class V modification of an engine based on cost data from the current quarter. It is recommended that if the denominator is zero in any of these formulas, the value used in the previous quarterly processing cycle be re-used in the current processing cycle, and adjusted for inflation as follows:

(1) From AFR 173-13, select the USAF raw inflation indices for O&M for the current year and the previous year.

(2) Subtract the index for the previous year from the index for the current year. Divide the result by 4, then add 1.

(3) The result is an approximate quarterly O&M inflation index.

(4) Multiply any average depot cost carried forward (because of no applicable depot activity in the current quarter) by this index.

More elaborate inflation adjustments can be imagined. The costs of labor, materials, and overhead could be adjusted separately. A quarterly inflation factor defined as the fourth root of the ratio of the annual factors would be infinitesimally more precise. Such refinements would entail significant procedural complications. Information Spectrum judges that the results would not justify the additional effort.

4.2a <u>Office of VAMOSC (OOV) Comments</u>

Concur. The current method used to compute average depot repair and modification costs relies on the assumption that repair/modification takes place for every TMS in every quarter. In the event that no such activity takes place for a particular TMS in a particular quarter, the average repair/modification cost will equal zero. Our reports will then show no costs for the

quarter regardless of the number of NRTS actions reported over the D042A system. Using the figure for the previous quarter and adjusting for inflation should alleviate this problem. A DAR requesting this change will be prepared and submitted by 3 May 84.

REFERENCES

[1] AF Regulation 400-31, Volume IV (6 August 1982), Visibility and Management of Operating and Support Cost Program (VAMOSC) Component Support Cost System (CSCS)

[2] FD-K-14010C, Functional Description (for the Component Support Cost System (CSCS), Data System Designator D160B, undated draft)

[3] SS-K-15010B, Component Support Cost System/Subsystem Specification, 1 June 1983

[4] TO-00-20-2, Technical Manual: The Maintenance Data Collection System, 1 November 1981

[5] TO-00-20-2-45-2, Operational Supplement to Technical Order: Maintenance Documentation for In-Shop Engine Maintenance, 1 October 1982

[6] Memoranda of Agreement (listed separately)

[7] Letter from Chief, Material, Cost & International Accounting Systems Division, Directorate of Plans & System, HQ USAF, dated 27 Feb 1981, Subject: Direct Labor Rates

[8] Air Force Magazine, May 1983 (Almanac Issue)

[9] AFLC Pamphlet 173-10, AFLC Cost and Planning Factors, 31 December 1981

[10] "A Statistical Evaluation of the Accuracy of Maintenance Direct Labor Data Used in Support of Operating and Support Costs." Desmatics, Inc. Final Report No. 111-1, by Dennis E. Smith, Robert L. Gardner, and Terry L. King, April 1979

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[21] TO-00-20-2-2, Technical Manual: On-Equipment Maintenance Documentation for Aircraft; Air-Launched Missiles; Ground-Launched Missiles; Except ICBMS; Drones; and Related Training Equipment, 1 August 1976, updated to 15 October 1982

[22] TO-00-20-2-10, Technical Manual: Off-Equipment Maintenance Documentation for Shopwork, Conventional Munitions, and Precision Measuring Equipment, 1 January 1978, updated to 1 August 1982

[23] AF Manual 66-267, Maintenance Data Collection System (MDC), DSDC: G001BD, Users Manual, 1 October 1979, updated to 1 January 1983

[24] Letter from Chief, Material Systems Division, Directorate of Comptroller Systems, Air Force Data Systems Design Center, to HQ AFLC/MM(VAMOSC), dated 15 September 1983, Subject: "D002A, Daily Consumable Material Cost Data Interface with D160B, Component Support Cost System (CSCS) (your ltr, 15 Aug 83)."

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[26] AFLC Regulation 72-2, Cataloging and Standardization, 3 March 1980, updated to 29 May 1982

[27] "Validation of the Algorithm for Base TCTO Overhead Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-02, 15 August 1983

[28] "Validation of the Algorithm for Base Labor Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-06, 13 December 1983

[29] DoD Handbook 7220.29-H, Department of Defense Depot Maintenance and Maintenance Support Cost Accounting and Production Handbook, updated through 13 September 1979

[30] AF Manual 400-1, Volume II, Comprehensive Engine Management System (D042) Engine Status, Configuration and TCTO Reporting Procedures, 1 October 1983

[31] "Validation of the Algorithms for Base Exchangeable Repair Costs (Engine) and Base Exchangeable Modification Costs (Engine) for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-10, 11 February 1984

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[33] "Validation of the Algorithm for Depot TCTO Labor Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-12, 12 April 1984

[34] "Validation of the Algorithm for Depot TCTO Material Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-13, 12 April 1984

[35] "Validation of the Algorithm for Depot TCTO Other Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-14, 12 April 1984

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[37] "Validation of the Algorithms for Base Exchangeable Repair Costs (NSN) and Base Exchangeable Modification Costs (NSN) for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-09, 11 February 1984

[38] AF Manual 67-1, "USAF Supply Manual," Vol. II (Ph IV) Part II, 1 February 1984

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[49] AFLC Regulation 66-61, Operational Planning, 27 October 1983

[50] "Validation of the Algorithms for Depot Support General, Labor, Direct Material, and Other Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-15, 12 April 1984

[51] AF Manual 177-206, Automated Material System Interfaced with Supply System at Base Level, Users Manual, 1 August 1979, updated to 1 February 1983.

[52] AF Regulation 66-1, Maintenance Management, Volume 3, Squadron Maintenance, 2 January 1980

[53] "Validation of the Algorithm for Base Inspection Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-04, 15 August 1983

MEMORANDA OF AGREEMENT FOR SYSTEM INTERFACES

Ref. No.	Memorandum No.	Date
[6.1]	D002A/M024B/D160B-A	9 Jun 1980
[6.2]	D002A/M024B/D160B-B	9 Jun 1980
[6.3]	D024A/D160B-A	30 Jun 1980
[6.4]	D033./ARC/D160B	14 Jun 1980
[6.5]	D042A/DNB/D160B	4 Nov 1983
[6.6]	D046/M024/D160B	9 Apr 1981
[6.7]	D046/D160B	23 Jun 1982
[6.8]	D056A/BDN/D160B-A	23 Jan 1981
[6.9]	D056A/D160B-C	13 Oct 1981
[6.10]	D056A/D160B-D	29 Jan 1981
[6.11]	D056A F005	25 Apr 1979
[6.12]	D056B/BDN/D160B-A	22 Dec 1980
[6.13]	D056C/D160B-A	4 Mar 1981
[6.14]	D071/D160B	17 Jun 1982
[6.15]	D143B/D002A 9159	3 Aug 1979
[6.16]	D143F/ARC/D160B-A	5 Feb 1981
[6.17]	D160/D160B	11 Jun 1982
[6.18]	G004L/M024B/D160B-A	30 May 1980
[6.19]	G004L/M024B/D160B-B	30 May 1980
[6.20]	G004L/M024B/D160B-C	5 Nov 1981
[6.21]	G019F/D160B	8 Sep 1982
[6.22]	G033B/D160B	12 Jul 1982
[6.23]	G072D/BDN/D160B-A	19 Apr 1982

MEMORANDA OF AGREEMENT FOR SYSTEM INTERFACES (Continued)

Ref. No.	Memorandum No.	Date
[6.24]	H036B/RC/D160B-A	10 Feb 1981
[6.25]	H069R/M024B/D160B-B	19 Jan 1981
[6.26]	O013/BDN/D160B	22 Jul 1982

Attachment 1: Proposed DAR Entries Supporting Modifications to VAMOSC Component Support Cost Subsystem (CSCS) to Improve Calculation of Base Exchangeable Repair and Modification Costs for NSNs

Requirement:

In the algorithms identified by Sections 5-15.e and in the "Repair % of Total Production" portion of 5-18 of AFR 400-31, Volume IV (6 August 1982), it is requested that all input data be the sum of the values for the most recent four quarters. In these calculations, if a denominator is zero, the output quantity from the previous quarterly processing cycle should be re-used.

In Sections 5-15c and in the "Depot Avg Mod Cost" portion of 5-18, the input data should be the values for the current quarter. In these calculations, if a denominator is zero, the output quantity from the previous quarterly processing cycle should be re-used.

In Sections 5-15c and in the "Depot Avg Mod Cost" portion of 5-18, the input data should be the value used for the previous quarterly processing cycle, adjusted for inflation by multiplying by a quarterly O&M inflation index. That index is calculated as follows:

(1) From AFR 173-13, select the USAF raw inflation indices for O&M for the current year and the previous year.

(2) Subtract the index for the previous year from the index for the current year. Divide the result by 4, then add 1.

Impact Statement

Failure to implement may contribute to erratic, non--representative fluctuations in estimates of exchangeable repair and modification costs for engines.

Justification Benefits/Cost Savings

Evaluation of the inaccuracy of the current procedure would require investigation and analysis. Such an investigation does not appear appropriate since in any event the required programming effort should be small.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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This study is the tenth of a set of reports documenting the findings of a study conducted by Information Spectrum, Inc (ISI) for the Office of VAMOSC, Air Force Logistics Command. This study constitutes an assessment of the algorithms for Base Exchangeable Repair and Modification Costs (Engine) within the Component Support Cost System (CSCS) subsystem of VAMOSC, the Air Force Visibility and Management of Operating and Support Cost system. CSCS deals with subsystems and components for aircraft.

20. This report combines the two algorithms because of the similarity of the subject matter and the computational processes. Engines are returned to the depot of maintenance when the work is beyond the capability of the base. At the depot the engines may be repaired or modified (or both). These algorithms estimate the repair and modification costs at the depot level. Because items are scheduled for efficient processing at depots, the work may take place months after receipt. The algorithms estimate costs to be incurred on the basis of depot experience with similar engines during the current reporting quarter.

This volume presents ISIs conclusions and recommendations, and the comments of the Office of VAMOSC.

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